EVALUATION OF THE ANTIMICROBIAL USE IN DEFINED DAILY DOSES IN HOSPITALS OF THE REPUBLIC OF MOLDOVA

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Summary

In the world exists more international [1, 2], supranational (regional) [3, 4], and national programs [5-15] aimed to survey the usage of antibiotics, involving dozens of countries which have thousands of hospitals and other public health institutions. The article aims at collating and evaluating data on antibiotics usage in the National Practical-Scientifical Centre of Emergency Medicine over a certain time. Present research covers antibiotics utilization data, as a rate based on defined daily doses, enables reporting and comparison of total-hospital usage for the period from January 2009 to January 2012. The average annual rate for total-hospital antibiotics utilization of defined daily doses per 1000 occupied occupied-bed days since 2009 had decreased from 662.4 to 542.4 in 2012. This report provides data which could be used to target particular areas of antibiotics usage. At the hospital level the usage trends is a parameter for identifying overall changes in prescribing practices.

Key words: antibiotics, consumption, hospital, program, defined daily doses, occupied-bed days, rational use

Rezumat. Evaluarea consumului de antibiotice în doze definite pentru o zi în spitalele din Republica Moldova

În lume există mai multe programe intrenaționale [1, 2], regionale [3, 4] şi naționale [5-15] scopul cărora este evaluarea consumului de antibiotice şi în care participă zeci de țări cu un număr de mii de spitale şi alte instituții medicale. În prezentul studiu a fost evaluat consumul de antibiotice în doze definite pentru o zi pe întreaga instituție în perioada din ianuarie 2009 până în ianuarie 2012. Media anuală pentru totalul consumului de antibiotice în doze definite pentru o zi pentru 1000 de paturi-zile ocupate din anul 2009 s-a micşorat de la 662,4 până la 542,4 în anul 2012. În urma prezentei evaluări sunt obținute date care pot fi utilizate pentru optimizarea utlizării antibioticelor inclusiv şi pentru cazuri particulare.

Cuvinte cheie: antibiotic, consum, spital, program, doze definite pentru o zi, zile-pat ocupate, utilizare rațională

Аннотация. Изучение показателей среднесуточного расхода определенных доз антибиотиков в лечебных учреждениях Республики Молдова

В настоящее время в мире действует ряд международных [1, 2] зональных [3, 4] и многонациональных [5-15] программ в которых принимают участие тысячи госпиталей и других лечебных учреждений десятков стран. Основной целью проводимых исследований является мониторинг расхода антибактериальных препаратов. В данной работе изложены результаты изучения показателей среднесуточного расхода определенных доз антибиотиков в лечебном учреждении в период с января 2009 по январь 2012 года. Продемонстрировано снижение расхода определенных среднесуточных доз антибиотиков в расчете на 1000 занятых больничных коек с 662.4 в 2009 г. до 542.4 в 2012 году. Выводы сделанные на базе полученного материала могут быть использованы для выработки рекомендаций направленных на оптимизацию применения антибактериальных препаратов как в данном конкретном лечебном учреждении, так и в целом по стране.

Ключевые слова: антибиотик, расход, госпиталь, программа, определенная среднесуточная доза, занятые койко-дни, рациональное использование

Introduction

National Scientifical-Practicalal Centre of Emergency Medicine of the Republic of Moldova (NSPCEM), was founded in 1959. Clinical Services of include: Orthopedic-Traumatology Clinic for 150 beds, Surgery Clinic for 150 beds, Neurosurgery Clinic for 80 beds, Neurology Clinic for 70 beds, Maxillo-facial clinic for 30 beds, Urology Clinic for 40 beds, Gynecology Clinic for 30 beds, Microsurgery Clinic for 30 beds, Municipal Center with 8 seats hemodialysis and 9 beds, Clinical intensive care unit for 30 beds, in total the above services of the NPSCEM include 619 beds, also includes 5 emergency medical help substation and 4 out-patient department of traumatology and orthopedics [16].

The primary aim of the study was to evaluate institutional representative data on antibiotics utilization for a period of four years (2009-2012), according to World Health Organization (WHO) requirements to determine value of Defined Daily

Doses (DDD) per 1000 occupied Occupied-Bed Days (OBD) and comparing these data with the results of the use of antibiotics in hospitals from other countries. Based on obtained data it aimed to make conclusions on the use of antibiotics in the institution and to propose recommendations for ensuring the optimization with antibiotics.

To determine DDD and compare the consumption of antibiotics for the period of 2009-2012, the statistics data concerning the number of treated patients (for only patients with health insurance and other free treated by the state categories of citizens), the number of bed/days and total annual quantities of antibiotics were used. The number of patients treated in the institution was 20946 in 2009, 21341 in 2010, 19913 in 2011 and 20664 in 2012 [17].

Because the Republic of Moldova is a developing country, today neither group of medical institutions or medical institution in general are having their own program or are participating in international or regional programs that deal with of antimicrobial use surveillance.

Antimicrobial data are aggregated over the time period of interest at hospital level and converted to standardized usage rates based on the WHO definition of DDD with 1000 OBD as the denominator.

Units of measurement

1. Defined daily doze (DDD)

The DDD for any drug is defined as the average dose per day to treat the main indication for an average adult patient according to the main indication. The WHO has determined DDDs standards for most drugs and these values have been used in calculating usage rates. The use of this internationally accepted standard enables to compare the usage of antibiotics with differing doses and with data from other surveillance programs or studies.

The number of defined daily doses used is calculated as follows:

$$\text{The number of DDD} = \frac{\text{Total grams used}}{\text{WHO assigned DDD value}}$$

2. Occpied bed days (OBD)

Occupied Bed Days are defined as the sum of the lengths of stay for each acutely adult inpatient detached during the reporting period that remained in hospital overnight [11, 13]. Day patients, outpatients, hospital-in-the-home and rehabilitation units in OBD are excluded.

In this research were not included the data about antibiotics ointments and eye drops consumption.

3. List of antibiotics with DDD used in NSPCEM (annex 1).

Aggregation of contributed data into therapeutic group allows:

- Assessment of relative use of particular classes;
- Benchmarking with usage data from similar studies;
- Comparison with the consumption of different periods of time.

Organization of study

For calculated antimicrobial Defined Daily Doses (DDDs) and DDDs per 1000 patient days [18] and other comparison analysis have been followed several steps:

Step 1: Performed encoding of each antibiotics remedy according to the WHO ATC classification in the drug record institutional system.

Step 2: The report on drugs consumption for the period of four years (2009-2012) has been obtained and then ensconced in accordance with ATC classification groups and subgroups of antibiotics.

Step 3: The conversion of all antibiotics usage to grams (or million units (MU)) where applicable.

Step 4: Obtained WHO assigned DDD value for utilizing antibacterials in NSPCEM from WHO Collaborating Centre for Drug Statistics Methodology Norwegian Institute of Public Health.

Step 5: To obtain yearly DDD for every antibiotics in the year 2009; 2010; 2011 and 2012 was divided the amount of grams of all antibiotics to WHO assigned DDD value.

Step 6: The DDD per one OBD has been obtained; therefore, the totals for each antibiotics in the years 2009; 2010; 2011 and 2012 and total annual DDD, was divided to a numbers of total occupied bed/days for the respective period of time.

Step 7: It was obtained the DDD/1000 OBD; therefore, the obtained DDD per one occupied day for every antibiotics and the total for the respective period of time, was multiplied by 1000.

Step 8: It was obtained the total of DDD/1000 occupied bed/days for every groups and subgroups of antibiotics. For that was accounted every antibiotics DDD/1000 OBD for respective groups and subgroups.

Step 9: It was determined separate data of parenteral and oral administration for the evaluation period of antibiotics.

Step 10: Based on the collected data from others scientific research was compare percentage of a total consumption and subgroups of antibiotics.

The evaluations results

Total-institutional for period of 2009-2012 yeas of antibiotics usage rate.

In figure 1 is demonstrated the total antibiotics

use rates of DDD/1000 OBD by WHO antibiotic groups (Parenteral and Oral Usage) in NSPCEM. The average aggregate annual rate for total-hospital antibiotics utilization period decreased from 662.4 DDD/1000 OBD in 2009 to 542.4 DDD/1000 OBD in 2012, or by 18, 12% **(Fig. 1).**

Annual usage rate data, aggregated by year and therapeutic group, for four years from January 2009 to January 2012, demonstrated a decline in usage rates for tetracyclines by 13.41%, beta-lactam antibiotics, penicillin by 10.41%, other beta-lactam antibiotics 16.69%, sulfonamides and trimethoprim from 5.7 to 0 DDD/1000 OBD, macrolides and lincosamides by 20.01%, quinolone antibiotics by 42.53%, other antibiotics by 58.97%, equally a unstable use of amphenicols and an encreased consumption for aminoglycoside antibiotics by 24.19% and and antimycotics for systemic by 32.23%. The usage rate for 2012 is showen near every grupe of antibiotics.

In figure 2 is presented trends of usage rates DDD/1000 OBD by WHO antibiotic groups (Parenteral Usage) in NSPCEM. The average consumption annual rate in the evaluation period for total-hospital antibiotics for parenteral usage decreased from 568.9 DDD/1000 OBD in 2009 to 460.10 DDD/1000 OBD in 2012, or by 19.13% **(Fig. 2)**.

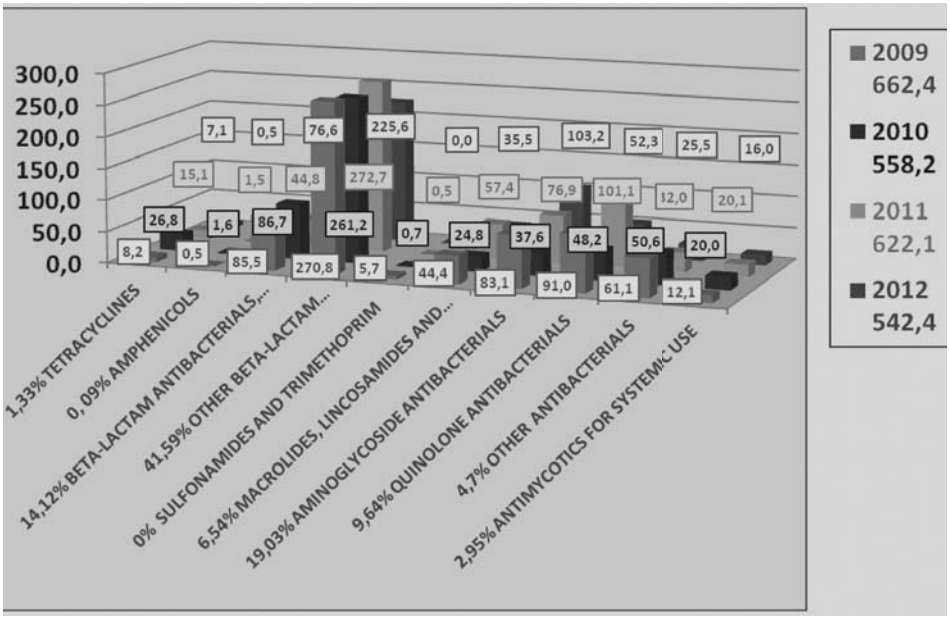

Fig. 1. *Total antibiotics usage rates DDD/1000 OBD in 2009-2012 (Parenteral and Oral Usage)*

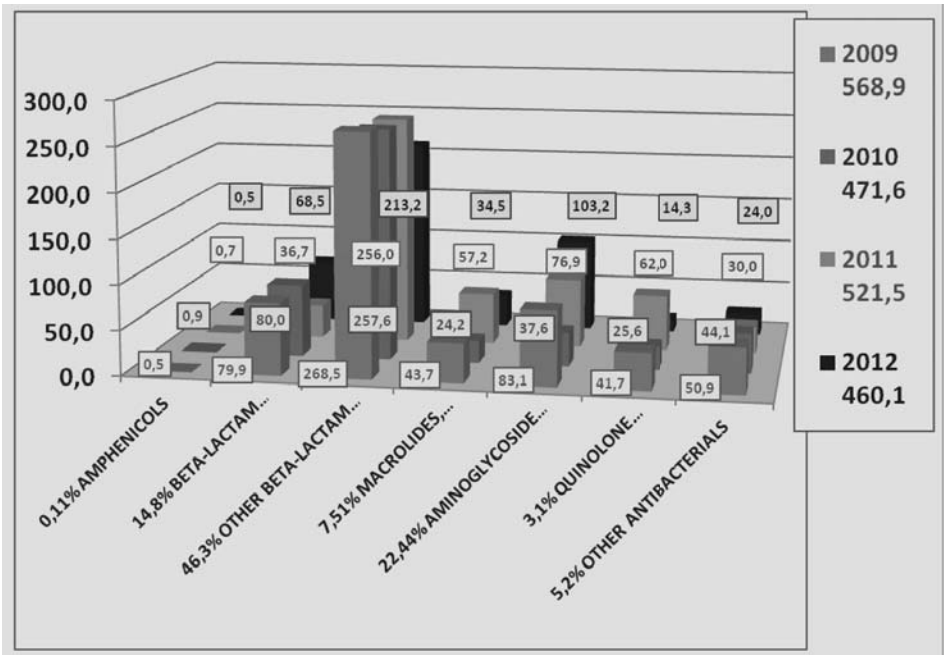

Fig. 2. *Total antibiotics usage rates DDD/1000 OBD in 2009-2012 (Parenteral Usage)*

A significant decrease usage was registered for quinolone antibiotics by 65.71% and other antibiotics by 52.85%, a decline in usage rates for beta-lactam antibiotics by 14.30%, other beta-lactam antibiotics with 20.60%, macrolides, lincosamides and streptogramins by 21.05%, and an encreased usage for aminoglycoside for systemic by 19.48%. An approximate constant yearly average consumption was registered for amphenicols.

In figure 3 are presented trends in large groups of antibiotics for oral use in NPSCEM in the evaluation period. The average consumption annual rate of antibiotics for oral usage decreased from 93.28 DDD/1000 OBD in 2009 to 82.25 DDD/1000 OBD in 2012, or by 11.83 %. The usage rate for 2012 is showen near every grupe of antibiotics **(Fig. 3)**.

A significant increase of usage was registered for beta- antibiotics by 44, 64%, other beta-lactam antibiotics by 82.26% and antimycotics for systemic by 19.01%. An unstabile usage was registered for tetracyclines, amphenicols and macrolides, lincosamides, sulfonamides and trimethoprim. The usage rate for 2012 is showen niar every grupe of antibiotics.

The annual trends consumption of antibiotics for parenteral and oral use is presented in **table 1**.

We can state that the usage trends of antibiotics for parenteral and oral use during the evaluated period, had been recorded approximately a constant percentage in comparison with the total consumption of all antibiotics, and, ranged for parenteral use with 1-1.1% (85.9%-84.8%) a slight decrease, and for oral use with 1-1.1% (14.1%-15.2%) a slight increment.

The percentage usage trends of DDD/1000 OBD per day of antibiotics group ATC J01 between the NPSCEM of Republic of Moldova and seven courtiers from Europe Union, such as: Bulgaria, Ireland, Estonia, Lithuania, Latvia, Sweden and Finland are presented in **table 2**.

Utilizing the DDD/1000 OBD per day data [19], we have calculated the percentage usage trends for the large antibiotics groups ATC J01 between the NSPCEM and seven courtiers from Europe Union. The results demonstrate that the average proportion of consumption in seven courtiers from Europe Union and NSPCEM are for tetracyclines 3.4:1, beta-lactam antibiotics 1.9:1, other beta- antibiotics 0.8:1, macrolides, lincosamides and streptogramins 1.1:1, quinolone antibiotics 1:1, other antibiotics 0.7:1.

In **table 3** is presented total-hospital usage rates of DDD/1000 OBD of antimicrobials between the NSPCEM and eleven international researches with the data from more than 2000 hospitals from European countries.

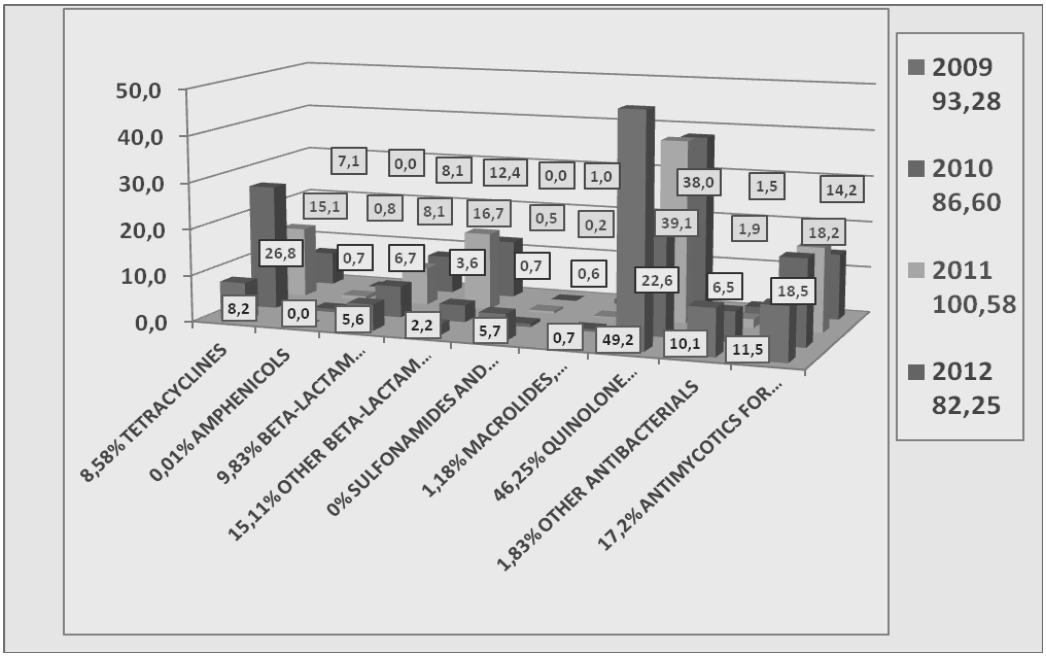

Fig. 3. *Total antibiotics usage rates DDD/1000 OBD in 2009-2012 (Oral Usage)*

Table 1

Trends of antibiotics for parenteral and oral usage in NSPCEM in 2009-2012

TOTAL parenteral	568.9	85,9%	471.6	84,5%	521.5	78,7%	460.1	84,8%
TOTAL oral	93.28	14,1%	86.6	15,5%	100.58	21,3%	82.25	15,2%
TOTAL	662.2		558.2		622.1		542.4	

Table 2

Percentage usage trends of DDD/1000 OBD per day of antibiotics group ATC

Country/ Antibacterial Groups	NSPCEM of RM	Bulgaria	Ireland	Estonia	Lithu-ania	Lat-via	Swe-den	Finland
Tetracyclines	1.33	1.42	1.12	4.44	2.5	3.0	12.01	7.5
Beta-lactam Penicilins	14.12	20.0	9.44	32.77	24.16	30.33	50.66	18.57
Other Beta-lactam antibiotics	41.59	51.44	49.44	26.11	22.5	37.66	13.33	32.5
Macrolides Lincosamides and streptogramins	6.54	7.85	14.44	10.55	2.5	4.33	4.0	5.35
Quinolone antibiotics	9.64	7.85	7.77	10.55	6.25	11.66	10.66	12.14
Other antibiotics	26.78	14.28	14.44	14.15	40.41	10.66	7.33	20.71

J01 between the NPSCEM of Republic of Moldova and seven European courtiers

Table 3

Comparison of total-hospital usage rates of DDD/1000 OBD of antibiotics between the NPSCEM and ten international researches

Hospitals	DDD/ 1000	Percentage consumption in the NSPCEM in comparison with eleven researchers
NSPCEM of Republic of Moldova	542.4	542.4 = 100%
34 public/43 private hospitals in France [20]	395/422	72.82%-77.80%
Antibiotic use in 530 French hospitals [21]	62.3–557.7	11.45%-102.82%
University Hospital of Geneva [22]	400	73,74%
Besancon University Hospital French [23]	535.4	98,71%
74 south-western French hospitals [24]	400-450	73.75%-82.97%
University Medical Center Rotterdam The Netherlands [25]	547	100.85%
1115 hospitals in France [26]	370-393	68.22% - 72,45%
University Hospital Huddinge, Sweden [27]	430	79.28%
139 hospitals from 30 European countries [28]	496	91.45%
All hospitals in Netherlands [4]	702	129.43%

The results shows, that in NPSCEM the consumption of antibiotics in comparison with ten international researches [20, 21, 22, 23, 24, 25, 26, 27, 28, 4] is at medium, with 9,06 % more. Where in five international researches the comparison is at medium with 25% more, in four around the same and in one case less than 29%.

Antibiotic class use rates in the period of January 2009 to January 2012

In figure 4 is presented the use rates of tetracycline (Doxycyclinum), amphenicols (Chloramphenicolum), penicillins with extended spectrum (Ampicillinum, Amoxicillinum) and combinations of penicillins, incl. beta-lactamase inhibitors (Amoxicillinum+Acidum clavulanicum, Ticarcillinum + Acidum clavulanicum) **(Fig. 4)**.

For the evaluated period is noted a general decrease by 10,62% of consumption of the mentioned grupes of antibiotics. Where decreased on one hand of tetracyclines by 13,42%, amphenicols by 0%, penicillins with extended spectrum by 13,88 times, on the other hand an increased of penicillins combination, incl. beta-lactamase inhibitors by 9,1 times.

The use rates of cephalosporins first generation (Cefalexinum, Cefazolinum), second generation (Cefuroximum, Cefaclorum), third generation (Cefotaximum, Ceftazidimum, Ceftriaxonum, Cefiximum, Cefoperazonum, Cefoperazonum and Sulbactamum) and carbapemens (Meropenemum, Imipenemum and Cilastatinum) are presented in **figure 5**.

From this figure we can differentiate two periods of concumption. First period 2009-2011 where first generation of cephalosporins decreased usage by 3,25 times, while the second and third generations of cephalosporins had increased the usage respectively by 2,83 and 2,70 times, and second period 2011-2012 where first generation of cephalosporins increased usage by 1,73 times, while the second and hird generations of cephalosporins had decreased the usage respectively by 4,96 times and 34,36%. At all in the evaluation period first generation of cephalosporins decreased the usage by 46,83%, second generation of

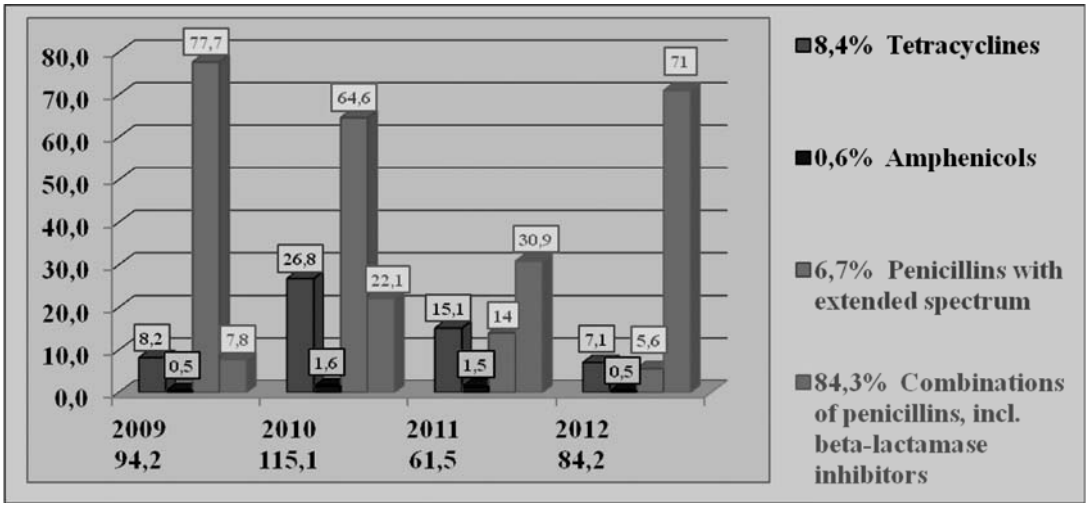

Fig. 4. *The use rates of tetracyclines, amphenicols, beta-lactam antibiotics and penicillins DDD/1000 per DAY in 2009-2012*

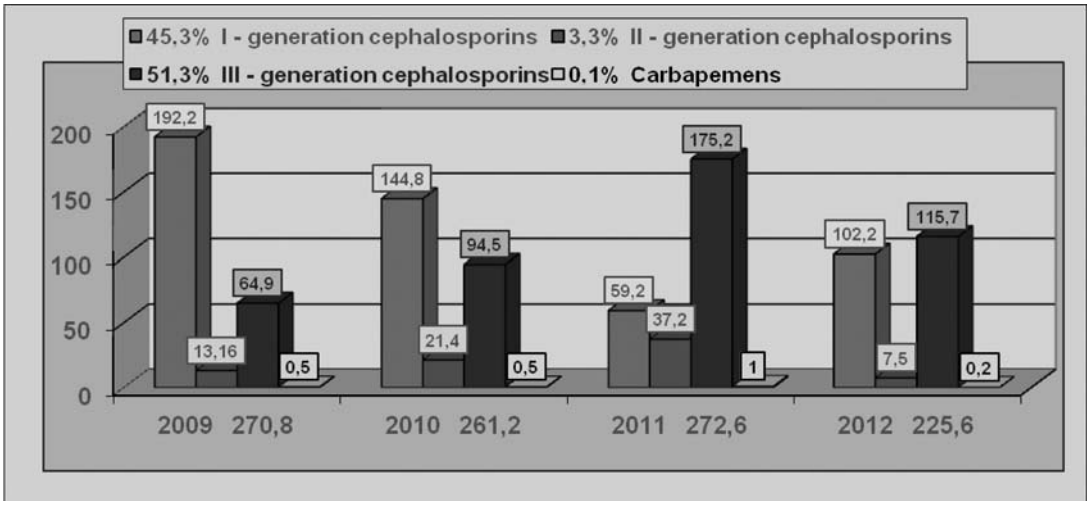

Fig. 5. *Usage rates of other beta-lactam antibiotics DDD/1000 per DAY in 2009-2012*

cephalosporins by 43,01%, while third generations of cephalosporins increased the consumption with 43,91%. The total consumption of other beta-lactam antibiotics from the evaluation period had deceased with 16.69%.

The usage rates of macrolides (Erytromycinum, Midecamycinum, Clarithromycinum, Azithromycinum), lincosamides (Lincomycinum), other aminoglycosides (Gentamycinum, Kanamycinum, Amikacinum) and fluoroquinolones (Ofloxacinum, Ciprofloxacinum, Norfloxacinum, Mofloxacin, Gatifloxacinum, Acidum pipemidicum) from 2009 till 2012 is presented in **figure 6.**

In this figure we can see an aproximately proportional consumption of all those subgroups of antibiotics in 2009 and 2011 as well in 2010 and 2012 without other aminoglycosides. All the evaluation period is characterised with an instabil consumption, an increased and decreased around and more than 50%, of usage of each grup of those antibiotics.

In **figure 7** is presented the usage rates of antibiotics (Vancomycinum), imidazole derivatives (Metronidazolum), nitrofuran derivatives (Furazidinum, Nitrofurantoinum) and other antibacterials (Dioxydinum, Nitroxolinum).

From 2009 to 2012 the usage rates of other antibiotics had decreased by 58,43%, from which: imidazole derivatives by 55,93%, nitrofuran derivatives by 85,86%. Other antibiotics and glycopeptide antibiotics had encountered a low and instabil consumption.

The usage rates of antimycotics for systemic use are presented in **figure 8.**

As seen in this figure, the total consumption of this group in the evaluation period increased by 32,23%, from which usage of imidazole derivatives

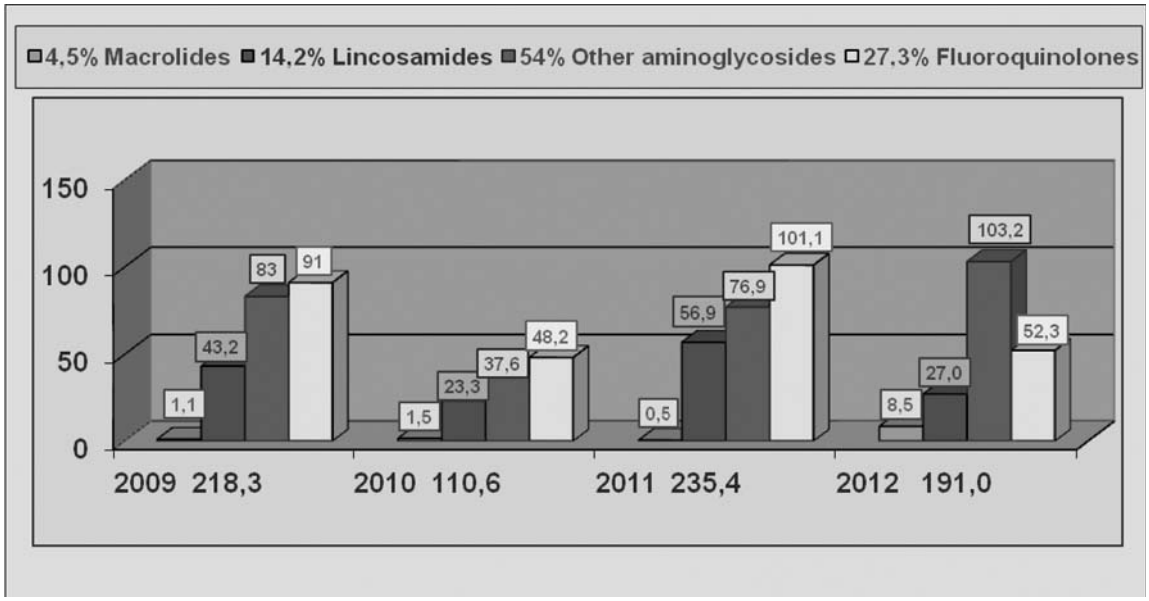

Fig. 6. *Usage rates of macrolides, lincosamides and aminoglycosides and quinolone antibiotics DDD/1000 per DAY in 2009-2012*

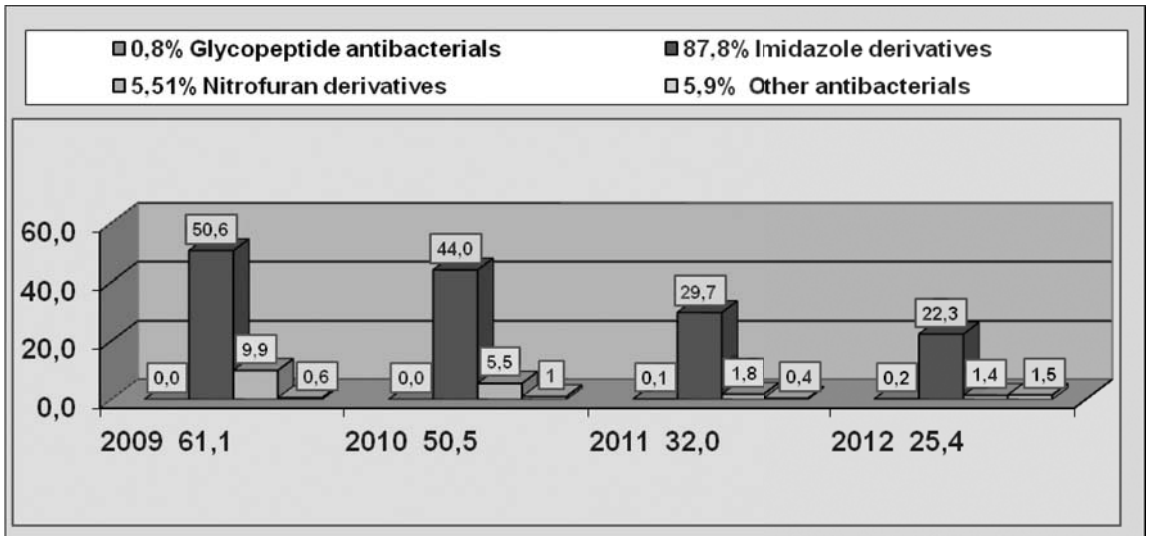

Fig. 7. *Usage rates of glycopeptide antibiotics, imidazole derivatives, nitrofuran derivatives and other antibiotics DDD/1000 per DAY in 2009-2012*

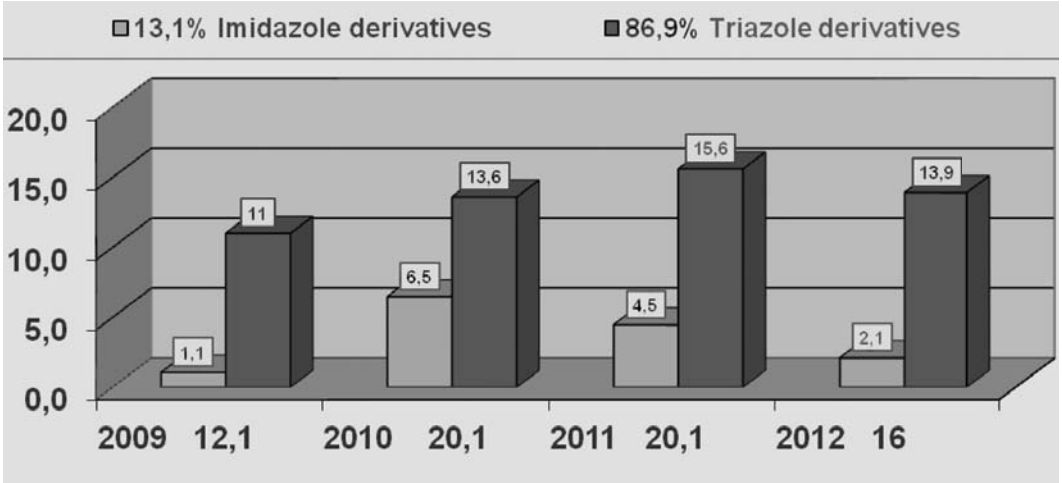

Fig. 8. *Usage rates of antimycotics for systemic use DDD/1000 per DAY in 2009-2012*

(Ketoconazolum) encoutered a high usage in 2010 by 5,91 times more and triazole derivatives (Fluconazolum) in 2011 with 41,82% more comparative with 2009.

Conclusions

1. The average annual rate for total-hospital antibiotics utilization of Defined Daily Doses per 1000 occupied Occupied-Bed Days (DDD/1000 OBD) since 2009 had decreased from 662,4 to 542,4 or by 18,12%, where antibiotics for parenteral and oral usage represents respectively 568,9 to 460,1 and 93.28 to 82,25 or a medium of 85% and 15%.

2. The percentage usage trends of DDD/1000 OBD per day of ATC J01 antibiotics groups, from the total in the NSPCEM, in comparison with the same medium percentage of seven courtiers from Europe Union, demonstrated that the greater differences of this proportion are in tetracyclines (1:3.4) and beta-lactam antibiotics (1:1.9). The consumption of DDD/1000 OBD per day antibiotics in comparison with ten international researches is at medium with 9,06% more. From which in five more than 25%, in four around the same and in one case less than 29%.

3. The utilization spectrum of antibiotics for systemic use in the evaluation period includes 10 groups with 18 subgroups of antibiotics. In 2012 three antibiotic classes with the rate of DDD/1000 OBD per day of total consumption more than 10% reprezents (beta-lactam with 14,12%, other beta-lactam with 41,59% and aminoglycozide antibiotics with 19,03%) which accounts 74,74%, other three antibiotics classes with consumption between 3% and 10% of the total reprezents (macrolides and lincosamides with 6,54%, quinolone antibiotics with 9,64% and other antibiotics with 4,7%) which accounts 20.88% and the last three antibiotic classes with consumption less than 3% reprezents (tetracyclines with 1,33%, aminophenols with 0,09% and antimycotics for sistemic use) which accounts 4,38%.

4. From the evaluation period was determened a considerable decreased in consumption of DDD/1000 OBD per day of penicillins with extended spectrum from 77,7 to 5,6 or by 13,88 times, first and second generation of cephalosporins respectively from 192,2 to 102,2 and 13,16 to 7,5 or with 46.83% and 43,01%, imidazole and nitrofuran derivatives from 50.6 to 22,3 and 9,9 to 1,4 or with 55,93% and 85,86%, an increased in consumption of penicillins combination, incl. beta-lactamase inhibitors by 9,1 times and third generations of cephalosporins by 43,91%. An insabil consumption has been found of macrolides, lincosamides, aminoglycosides and quinolone antibiotics.

5. One of the objectives of the present research, results in a clearly demonstration that the health system of the Republic of Moldova have not implemented any internationally recognized unites and programs to measure the drugs utilization studies. This puts the entire health care system in terms of inability to compare the consumption of drugs with similar institutions of other health systems and, therefore, disabling the qualitative determination of planning the necessary drugs and their rational use.

Suggestions

1. First of all the proposal is to introduce in the practice of medical institutions of the Republic of Moldova the ATC/DDD as an internationally recognized tool for the drug utilization research in order to improve the quality of drug use, the comparison of drugs' consumption statistics at international, regional, national and other levels.

2. Based on WHO and others research programs, it is rational to elaborate and further adopt a state program to survey the antibiotics use.

3. To estimate a structure at the national health system level for the practical implementation, that will:

- Provide regular and qualitative feedback to contributing hospitals, enabling examination of antibiotics usage rates and identification usage targets for intervention programs;

- Examine trends in antibiotics use at state and national levels to inform large scale interventions to rationalize hospital antibiotics prescribing;

- Provide our institutional peer group benchmark and enable comparison with other international institutional data and increased healthcare costs, and others goals.

4. To continue research in the National Scientific and Practical Centre of Emergency Medicine in main directions, first all in intensive care unites and other departments with high and low consumption of antibiotics of systemic use as infectious departments of surgery and orthopedic.

Annex 1

WHO Defined Daily Doses (DDD) for utilizing antibacterials in National Scientific and Practical Centre of Emergency Medicine (NSPCEM)

ATC classification	International name of antibacterials	ROUTE	DDD (g)
J	**J ANTIINFECTIVES FOR SYSTEMIC USE**		
J01	**J01 ANTIBACTERIALS FOR SYSTEMIC USE**		
J01A	**J01A TETRACYCLINES**		
J01AA02	Doxycyclinum	O	0,1
J01B	**J01B AMPHENICOLS**		
J01BA	J01BA Amphenicols		
J01BA01	Chloramphenicolum	O	3
J01BA01	Chloramphenicolum	P	3
J01C	**J01C BETA-LACTAM ANTIBACTERIALS, PENICILLINS**		
J01CA	J01CA Penicillins with extended spectrum		
J01CA01	Ampicillinum	O	2
J01CA01	Ampicillinum	P	2
J01CA04	Amoxycillinum	O	1
J01CA04	Amoxycillinum	P	1
J01CR	J01CR Combinations of penicillins, incl. beta-lactamase inhibitors		
J01CR02	Amoxicillinum + Acidum clavulanicum	O	1
J01CR02	Amoxicillinum + Acidum clavulanicum	P	3
J01CR03	Ticarcillinum + Acidum clavulanicum	P	15
J01D	**J01D OTHER BETA-LACTAM ANTIBACTERIALS**		
J01DB	J01DB First-generation cephalosporins		
J01DB01	Cefalexinum	O	2
J01DB04	Cefazolinum	P	3
J01DC	J01DC Second-generation cephalosporins		
J01DC02	Cefuroximum	O	0,5
J01DC02	Cefuroximum	P	3
J01DC04	Cefaclorum	O	1
J01DD	J01DD Third-generation cephalosporins		
J01DD01	Cefotaximum	P	4
J01DD02	Ceftazidimum	P	4
J01DD04	Ceftriaxonum	P	2
J01DD08	Cefixim	O	0,4
J01DD12	Cefoperazonum	P	4
J01DD62	Cefoperazonum + Sulbactamum	P	4
J01DH	J01DH Carbapenems		
J01DH02	Meropenemum	P	2
J01DH51	Imipenemum+Cilastatinum	P	2
J01E	**J01E SULFONAMIDES AND TRIMETHOPRIM**		
J01EE	J01EE Combinations of sulfonamides and trimethoprim, incl. derivatives		
J01EE01	Sulfamethoxazolum + Trimethoprimum	O	1,9
J01F	**J01F MACROLIDES, LINCOSAMIDES AND STREPTOGRAMINS**		
J01FA	J01FA Macrolides		
J01FA01	Erytromycin	O	1
J01FA03	Midecamycinum	O	1
J01FA09	Clarithromycinum	O	0,5
J01FA09	Clarithromycinum	P	0,5
J01FA10	Azithromycinum	O	0,3
J01FA10	Azithromycinum	P	0,5
J01FF	J01FF Lincosamides		
J01FF02	Lincomycinum	P	1,8
J01G	**J01G AMINOGLYCOSIDE ANTIBACTERIALS**		

J01GA	J01GA Streptomycins		
J01GA01	Streptomycinum	P	1
J01GB	J01GB Other aminoglycosides		
J01GB03	Gentamycinum	P	0,2
J01GB04	Kanamycinum	P	1
J01GB06	Amikacinum	P	1
J01M	**J01M QUINOLONE ANTIBACTERIALS**		
J01MA	J01MA Fluoroquinolones		
J01MA01	Ofloxacinum	O	0,4
J01MA01	Ofloxacinum	P	0,4
J01MA02	Ciprofloxacinum	O	1
J01MA02	Ciprofloxacinum	P	0,5
J01MA06	Norfloxacinum	O	0,8
J01MA14	Mofloxacin	P	0,4
J01MA16	Gatifloxacinum	O	0,4
J01MA16	Gatifloxacinum	P	0,4
J01MB04	Acidum pipemidicum	O	0,8
J01MB04	Acidum pipemidicum	P	0,8
J01R	**J01R COMBINATIONS OF ANTIBACTERIALS**		
J01RA	Ciprofloxacinum + Tinidazolum	O	2
J01X	**J01X OTHER ANTIBACTERIALS**		
J01XA	J01XA Glycopeptide antibacterials		
J01XA01	Vancomycinum	P	2
J01XD	J01XD Imidazole derivatives		
J01XD01	Metronidazolum	P	1,5
J01XE	J01XE Nitrofuran derivatives		
J01XE,G01AX	Furazidinum	O	0,2
J01XE01	Nitrofurantoinum	O	0,2
J01XX	J01XX Other antibacterials		
J01XX	Dioxydinum	P	0,7
J01XX07	Nitroxolinum	O	1
J02AB	**J02AB Imidazole derivatives**		
J02AB02	Ketoconazolum	O	0,2
J02AC	J02AC Triazole derivatives		
J02AC01	Fluconazolum	O	0,2
J02AC01	Fluconazolum	P	0,2
P = parenteral, O = oral			

WHO Defined Daily Doses (DDD) for utilizing antibacterials in National Scientific and Practical Centre of Emergency Medicine (NSPCEM)

ATC classification	**International name of antibacterials**	**ROUTE**	**DDD (g)**
J	**J ANTIINFECTIVES FOR SYSTEMIC USE**		
J01	**J01 ANTIBACTERIALS FOR SYSTEMIC USE**		
J01A	**J01A TETRACYCLINES**		
J01AA02	Doxycyclinum	O	0,1
J01B	**J01B AMPHENICOLS**		
J01BA	J01BA Amphenicols		
J01BA01	Chloramphenicolum	O	3
J01BA01	Chloramphenicolum	P	3
J01C	**J01C BETA-LACTAM ANTIBACTERIALS, PENICILLINS**		
J01CA	J01CA Penicillins with extended spectrum		
J01CA01	Ampicillinum	O	2
J01CA01	Ampicillinum	P	2
J01CA04	Amoxycillinum	O	1
J01CA04	Amoxycillinum	P	1

J01CR	**J01CR COMBINATIONS OF PENICILLINS, INCL. BETA-LACTAMASE INHIBITORS**		
J01CR02	Amoxicillinum + Acidum clavulanicum	O	1
J01CR02	Amoxicillinum + Acidum clavulanicum	P	3
J01CR03	Ticarcillinum + Acidum clavulanicum	P	15
J01D	**J01D OTHER BETA-LACTAM ANTIBACTERIALS**		
J01DB	J01DB First-generation cephalosporins		
J01DB01	Cefalexinum	O	2
J01DB04	Cefazolinum	P	3
J01DC	J01DC Second-generation cephalosporins		
J01DC02	Cefuroximum	O	0,5
J01DC02	Cefuroximum	P	3
J01DC04	Cefaclorum	O	1
J01DD	J01DD Third-generation cephalosporins		
J01DD01	Cefotaximum	P	4
J01DD02	Ceftazidimum	P	4
J01DD04	Ceftriaxonum	P	2
J01DD08	Cefixim	O	0,4
J01DD12	Cefoperazonum	P	4
J01DD62	Cefoperazonum + Sulbactamum	P	4
J01DH	J01DH Carbapenems		
J01DH02	Meropenemum	P	2
J01DH51	Imipenemum+Cilastatinum	P	2
J01E	**J01E SULFONAMIDES AND TRIMETHOPRIM**		
J01EE	J01EE Combinations of sulfonamides and trimethoprim, incl. derivatives		
J01EE01	Sulfamethoxazolum + Trimethoprimum	O	1,9
J01F	**J01F MACROLIDES, LINCOSAMIDES AND STREPTOGRAMINS**		
J01FA	J01FA Macrolides		
J01FA01	Erytromycin	O	1
J01FA03	Midecamycinum	O	1
J01FA09	Clarithromycinum	O	0,5
J01FA09	Clarithromycinum	P	0,5
J01FA10	Azithromycinum	O	0,3
J01FA10	Azithromycinum	P	0,5
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J01FF02	Lincomycinum	P	1,8
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J01GA	J01GA Streptomycins		
J01GA01	Streptomycinum	P	1
J01GB	J01GB Other aminoglycosides		
J01GB03	Gentamycinum	P	0,2
J01GB04	Kanamycinum	P	1
J01GB06	Amikacinum	P	1
J01M	**J01M QUINOLONE ANTIBACTERIALS**		
J01MA	J01MA Fluoroquinolones		
J01MA01	Ofloxacinum	O	0,4
J01MA01	Ofloxacinum	P	0,4
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J01MA02	Ciprofloxacinum	P	0,5
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J01MA14	Mofloxacin	P	0,4
J01MA16	Gatifloxacinum	O	0,4
J01MA16	Gatifloxacinum	P	0,4
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J01MB04	Acidum pipemidicum	P	0,8
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J01XA	J01XA Glycopeptide antibacterials		
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J01XD01	Metronidazolum	P	1,5
J01XE	J01XE Nitrofuran derivatives		
J01XE,G01AX	Furazidinum	O	0,2
J01XE01	Nitrofurantoinum	O	0,2
J01XX	J01XX Other antibacterials		
J01XX	Dioxydinum	P	0,7
J01XX07	Nitroxolinum	O	1
J02AB	**J02AB Imidazole derivatives**		
J02AB02	Ketoconazolum	O	0,2
J02AC	J02AC Triazole derivatives		
J02AC01	Fluconazolum	O	0,2
J02AC01	Fluconazolum	P	0,2
P = parenteral, O = oral			

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